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U.S. DEPARTMENT OF AGRICULTURE.
1893

REPORT

OF THE

ORNITHOLOGIST AND MAMMALOGIST

FOR

1893.

BY

C. HART MERRIAM.

FROM THE REPORT OF THE SECRETARY OF AGRICULTURE FOR 1893.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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REPORT OF THE ORNITHOLOGIST AND MAMMALOGIST.

SIR: I have the honor to submit herewith my eighth annual report on the work of the Division of Ornithology and Mammalogy, covering the year 1893.

Very respectfully,

C. HART MERRIAM,
Chief.

Hon. J. STERLING MORTON,
Secretary.

WORK OF THE YEAR.

The efforts of the division have been directed largely toward the completion of investigations begun in previous years, investigations relating both to the determination of the natural faunal or life zones of the country, and to the food habits and distribution of mammals and birds of economic importance to agriculture.

Three publications have been issued during the year: (1) An economic bulletin on the hawks and owls of the United States; (2) an economic bulletin on the prairie ground squirrels or spermophiles of the Mississippi Valley; (3) a technical publication containing part of the results of the Death Valley Expedition.

The work on hawks and owls was illustrated by 26 fine colored plates, paid for out of the lump fund of the division, and was in such demand that the edition of 5,000 copies was exhausted almost as soon as published, since which time many thousands of additional applications for it have been received.

The bulletin on prairie ground squirrels was illustrated by 3 full-page colored plates and by colored maps showing the area inhabited by each species. The edition (also 5,000 copies) proved insufficient for the demand and is now practically exhausted.

A bulletin on the crow, comprising the results of several years' study of the relations of this interesting bird to agriculture, is now ready for the press; and a bulletin on the pocket gophers, similar in scope and character to the one already issued on the prairie ground squirrels, will probably be ready for distribution before the present report is issued. Other bulletins are in an advanced stage of preparation.

In the year 1893 more than 6,500 letters were received, many of them accompanied by schedules, reports, and miscellaneous notes, all of which were examined and filed for future reference. During the same time about 3,800 letters were written, several hundred schedules distributed to observers and correspondents, and upwards of 700 packages

sent out. Other routine work has consisted in the identification of specimens (about 400 separate lots or packages of which have been received), forwarding supplies to field agents, the care of collections, correcting proof, compiling reference lists of publications useful in the work of the division, and miscellaneous work.

SCOPE OF THE WORK.

The investigations carried on by the division are naturally divided into two groups—one relating to the geographic distribution of species in the widest sense, the other confined to the study of birds and mammals of immediate interest to the farmer because of their relation to agriculture. During the year work has been pushed along these lines as vigorously as the means at command would allow.

GEOGRAPHIC DISTRIBUTION.

The interest of the agriculturist in the study of geographic distribution lies in the fact first pointed out by this division, that the territory of the United States may be divided into a definite number of belts or zones, each of which is characterized by the presence of certain native animals and plants and which, under cultivation, is fitted for particular agricultural products. The reason why certain animals and plants are restricted to particular areas or belts, where no visible barriers exist to prevent dispersion, is that the sensitive organizations of such species have become adapted to the particular physical and climatic conditions there prevalent and are not sufficiently plastic to enable them to live under other conditions. What is true of animals and plants in a state of nature is true also of animals and plants as modified by man; for every race or breed of sheep, cattle, or swine, and every variety of grain, vegetable, or fruit thrives best under particular conditions of temperature, moisture, and exposure.

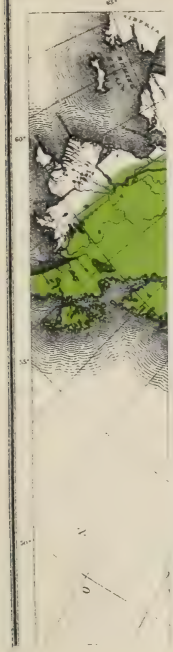
The number of life zones that have been defined in this country north of the tropical is six. They may be grouped under two heads: Northern or *Boreal* and southern or *Austral*. In Eastern North America these zones may be briefly characterized as follows, beginning at the north:*

(1) *Arctic or Arctic-Alpine Zone*, above the limit of tree growth; characterized by the Arctic poppy, dwarf willow, saxifrages, gentians, and many other plants, and by the snow bunting, snowy owl, white ptarmigan, polar bear, arctic fox, and barren-ground caribou or reindeer. This zone is of no agricultural importance.

(2) *Hudsonian Zone*, comprising the northern or higher parts of the great transcontinental coniferous forest—a forest of spruces and firs stretching from Labrador to Alaska. Among the numerous inhabitants of this zone are the wolverine, woodland caribou, moose, great northern shrike, pine bullfinch, crossbills, white-crowned sparrow, and fox sparrow. Like the last this zone is of no agricultural importance.

(3) *Canadian Zone*, comprising the southern or lower part of the great transcontinental coniferous forest, and inhabited by the porcupine, varying hare, red squirrel, white-throated sparrow, yellow-rumped warbler, and numerous others. Counting from the north, this zone is the first of any agricultural consequence. Here white potatoes, turnips, beets, the Oldberg apple, and the more hardy cereals may be cultivated with moderate success.

* On the accompanying map (Plate I) the two Boreal forest zones—the Hudsonian and Canadian—have not been separated but are shown together in green.



METHOD OF WORK.

The collection of data on the distribution of species was begun by the writer several years before the establishment of the division and

Boreal Zone

Transition Zone

Upper Sonoran

Carolinian

Lower Sonoran

Austroriparian

Tropical

Boreal Region.	Arctic.	
	Boreal.	
Austral Region.	Transition	
	Upper Austral.	
	Lower Austral.	
Tropical Region.	Tropical.	

THIRD PROVISIONAL BIO-GEOGRAPHIC MAP OF NORTH AMERICA

Showing the Principal Life Areas

BY

DR. C. HART MERRIAM.

Dec. 1893.

The increase in intensity of color in the Austral Zones east of the Great Plains indicates the extent of the humid divisions of these Zones, known respectively as the *Alleghanian*, *Carolinian* and *Austroriparian Faunas*.

The upper border of the green indicates the northern limit of trees.

vated with moderate success.

*On the accompanying map (Plate I) the two Boreal forest zones—the Hudsonian and Canadian—have not been separated but are shown together in green.

(4) *Transition Zone*, or belt in which the outlying Boreal and Austral elements overlap. Here the oak, hickory, chestnut, and walnut of the south meet the maple, beech, birch, and hemlock of the north. The same is true of mammals and birds, for here the southern mole and cottontail rabbit, the oriole, bluebird, catbird, thrasher, chewink, and wood thrush live in or near the haunts of the hermit and Wilson's thrushes, solitary vireo, bobolink, red squirrel, jumping mouse, chipmunk, and star-nosed mole. In this zone we enter the true agricultural part of our country; here the apple (Oldberg, Baldwin, Greening, Seek-no-further, and others), the blue plums, cherry, white potato, barley, and oats attain their highest perfection.

(5) *Carolinian Zone*, where the sassafras, tulip tree, hackberry, sweet gum, and persimmon first make their appearance, together with the opossum, gray fox, fox squirrels, cardinal bird, Carolina wren, tufted tit, yellow-breasted chat, and gnatcatcher. In this zone the Ben Davis and wine-sap apples, the peach, apricot, quince, sweet potato, tobacco, and the hardier grapes, such as the Concord, Catawba, and Isabella, reach their best condition.

(6) *Austroriparian Zone*, where the long-leaved pine, magnolia, and live oak are common on the uplands and the bald cypress and cane in the swamps. Here the mockingbird, painted bunting, red-cockaded woodpecker, and chuck-wills-widow are characteristic birds, and the cotton rats, ricefield rats, wood rats, little spotted skunks, and free-tailed bats abound. This is the zone of the cotton plant, sugar cane, rice, pecan, and peanut; of the oriental pears (LeConte and Kieffer), the scuppernong grape, and of the citrus fruits—the orange, lemon, lime, and shaddock. In its western continuation (the Lower Sonoran) the raisin grape, olive, and almond are among the most important agricultural products, and the fig ripens several crops each year.

Still further south is the *Tropical* region, which, in the United States, is restricted to southern Florida and extreme southeast Texas, along the lower Rio Grande and Gulf coast. Among the tropical trees that grow in southern Florida are the royal palm, Jamaica dogwood, machineel, mahogany, and mangrove; and among the birds may be mentioned the white-crowned pigeon, Zanaida dove, quail doves, Bahama vireo, Bahama honey-creeper, and caracara eagle. The banana, coacoanut, date palm, pineapple, mango, and cherimoyer thrive in this belt.

The Division of Ornithology and Mammalogy is engaged in tracing the courses of these various zones across the continent and in the preparation of large scale maps on which their boundaries are shown in different colors. These maps should be of value to the agriculturist in showing the position of his farm with reference to the life zone in which it lies, thus giving him a key to the crops most likely to succeed, for it has just been shown that the fauna and flora of a region may be made to serve as a reliable index to its agricultural capabilities. The further from the center of abundance a particular crop can be made to thrive the higher price it will command, always provided it is near a market. Hence the importance of utilizing the northern prolongations and islands of the southern zones and the southern prolongations and islands of the northern zones for the cultivation of agricultural products that otherwise must be transported considerable distances.

METHOD OF WORK.

The collection of data on the distribution of species was begun by the writer several years before the establishment of the division and

has been carried on almost continuously to the present time. Since the enlargement of the scope of the investigation, authorized by Congress in 1890, the work has been pressed with increased vigor and on a scale never before attempted. The aim from the first has been to obtain accurate and complete data for mapping the distribution of individual species, and at the same time, by combining these maps and by independent field work, to ascertain the boundaries of the natural life zones of the country.

In order to secure the utmost economy of time and labor in the preparation of these maps, the published information relating to each species and all manuscript records in the possession of the division are first carefully tabulated on schedules, care being taken to reject everything which is not entirely reliable. In mapping birds it is necessary to separate the records of the breeding ranges from those of the winter and migration ranges of each species. The localities tabulated on the schedules are transferred to large scale maps, each record on the schedule being indicated on the map by a red spot at the point where the species in question has been found. The area within the peripheral spots is then carefully colored by some one personally familiar with the topography of the region. Thus the map becomes a graphic representation of the schedule, and vice versa the latter may be regarded as an index to and authority for the map. This map now forms the basis of field investigations, the object of which is to trace out in greater detail the actual boundaries of the distribution of the species. By studying at one time the ranges of all the species inhabiting a given region the work is carried on rapidly and economically.

BIOLOGICAL SURVEYS.

In 1889 a system of biological surveys was begun for the purpose of mapping in detail the boundaries of the natural life zones of our country, at the same time securing data and specimens illustrating the distribution and status of the various species. The San Francisco Mountain plateau in northern Arizona was selected for work the first season (1889), and an area of some 12,000 square miles was mapped. In 1890 a reconnaissance was made of nearly 20,000 square miles in Idaho. In 1891 the Death Valley Expedition was engaged in similar work in the arid region of southern California and Nevada, and covered about 100,000 square miles between the Colorado River and the Pacific Ocean, connecting on the east with the field work of 1889. Thus, up to the beginning of 1892 there had been surveyed with more or less detail an area larger than the whole of New England, with New York and New Jersey added, or, approximately, equal to the States of Nebraska and Iowa combined.

A much larger area had been covered in a different way by field agents who have been engaged in securing data in various localities and in supplementing the work of the biological surveys.

The greatest drawback to the satisfactory completion of the biological maps is the lack of accurate topographic contour maps to serve as bases for plotting distribution. The map sheets of the U. S. Geological Survey, as far as published, have proved of the utmost assistance and value.

FIELD WORK IN 1893.

During the present year the biological survey of the Rocky Mountain region has been carried from Utah and Idaho completely across the

State of Wyoming, thus connecting the work of previous years in the Great Basin with the western part of the Great Plains. A large part of Wyoming was found to be from 1,000 to 3,000 feet lower than represented on the latest maps, and consequently to have a warmer summer climate and to belong to a more southern life zone than previously supposed. Thus the Wind River and Bighorn basins and the plains east of the Bighorn Mountains fall within the Upper Sonoran Zone instead of the Transition. This area is of considerable importance from an agricultural standpoint, from the fact that it marks the northern extension of the ranges of certain southern species of plants and animals. A special effort was made to determine the position of the boundary between the Upper Sonoran and Transition zones in the States of Nebraska, North and South Dakota, and Montana. Further south, field work was carried on in Kansas, Colorado, and New Mexico; and further west, in California, Nevada, and western Oregon.

The study of the faunal affinities and agricultural resources of the arid tropical and semitropical or Lower Sonoran zones on the table-land of Mexico has been continued during the year, with the result that material and data of great value have been accumulated which throw light upon problems presented in corresponding areas in the arid regions of the southwestern United States.

ECONOMIC RELATIONS.

Work under this head consists in the study of those habits of birds and mammals which have a direct bearing on agriculture, favorable or unfavorable, and in the preparation of the results for publication. Information is obtained mainly by the following methods: (1) By study of the habits of species in the field, both by the division staff and by voluntary agents; (2) by the examination in the laboratory of the contents of stomachs and crops, with a view to the accurate determination of the character of the food; (3) by study of the literature of the subject, which involves the collation of published notes from widely scattered sources.

Supplementary investigations and experiments frequently become necessary for the settlement of particular questions, such as the best methods of limiting or exterminating harmful species, or of protecting and encouraging those which are beneficial.

The bulletin on the common crow, announced last year as practically finished except for the report on the insect contents of the stomachs, was somewhat delayed by the receipt of several hundred additional stomachs, and still further by the fact that the entomologist's report on the insect food materially modified some of the conclusions, necessitating many changes in the text. It is now about ready for transmittal. This bulletin is based primarily on the examination of the stomachs of more than 900 crows, young and old, taken at all seasons of the year and from every section of the United States; and, in addition, contains summaries of the reports of several hundred correspondents, and a review of the published matter relating to the economic status of the crow. The percentage of each item of food has been determined and its importance estimated; and the insect food has been studied and reported on by specialists under the direction of the entomologist of the Department.

Good progress has been made on a similar bulletin relating to the crow blackbird, and more than 1,100 stomachs of that species have been examined. About 150 stomachs of other blackbirds were also exam-

ined, as well as 545 stomachs of woodpeckers, about 200 of the crow, and a few of other birds.* The total number of bird stomachs examined during the year is 2,064.†

The collection now numbers 20,102 stomachs, having been increased during the year by the addition of 3,900. This is not only the largest number added during any one year in the history of the division, but the stomachs are of unusual importance, being mainly those of the species directly affecting the interests of the agriculturist. The reference collection of seeds and other samples of bird food has also been materially increased.

EXHIBIT AT THE WORLD'S COLUMBIAN EXPOSITION.

Considerable time and labor were expended by the division in the preparation and installation of an exhibit for the World's Fair. The principal object in view was to show the character of the work in which this division is engaged. This was accomplished by graphic illustrations showing the geographic distribution of the mammals and birds in the United States and the economic status of the species. In the former line, the great fact that animals and plants are distributed in broad belts or zones, the boundaries of which are fixed primarily by temperature, was shown by means of three large models. One of these was a miniature mountain slope on which mounted specimens of characteristic mammals and birds were so assembled as to bring before the eye at a glance the successive faunas of different elevations. Another was a large topographic relief model of the area covered by the Death Valley Expedition. On this model, and on an adjoining relief map of the United States, the life zones were shown in different colors. The models were accompanied by enlarged photographs of desert scenery, with characteristic animals and plants. The subject was still further illustrated by maps of the United States, colored to show the areas inhabited by individual species and genera of mammals, birds, reptiles, and plants.

Groups of mammals and birds, beneficial and harmful, each handsomely mounted and surrounded by its accustomed food supply, constituted the exhibit which was designed to illustrate the economic relations of the species.

The importance of bird life to the farmer was further shown by an exhibit of the food of various species of birds, each item of which was carefully labeled. Groups of mounted hawks and owls in the act of killing or eating some animal habitually preyed upon, illustrated the gain or loss which each is likely to bring to the farmer. A series of stuffed skins of the birds, mice, squirrels, and other animals which have been found in the stomachs of various species showed interesting facts regarding the food habits of owls. These are but a few of the many novel features of the exhibit, which it is believed was both instructive and practical and justified the time devoted to its preparation.

* One hundred and forty-five stomachs of the kingbird or bee martin were examined during the year, and the results, together with those obtained from twenty-five previous examinations, form the basis of a special paper on the food of the kingbird, an abstract of which accompanies this report.

† This determination of the food of species by examination of the stomach contents forms one of the most important features in the economic work of the division. Most of the errors due to ordinary observation are eliminated, and a foundation of actual facts is obtained which, in connection with competent field work, insures reliable conclusions.

FOOD HABITS OF THE KINGBIRD OR BEE MARTIN.

(*Tyrannus tyrannus.*)

By Walter B. Barrows.

The kingbird or bee martin is the largest common flycatcher in the United States, and is too well known to need any extended description. It is widely distributed during the breeding season, nesting abundantly in all the States east of the Rocky Mountains, and less commonly in Idaho, Utah, Washington, eastern Oregon, and northeastern California. It winter it migrates southward to the West Indies, Mexico, Central and South America, a few remaining along the Gulf coast and in southern Texas.

During its stay in the United States the kingbird feeds mainly on insects, which form at least 85 per cent of all its food from April to September.

The material available for a study of the food of this bird includes the published records by various naturalists of something less than fifty dissections made at different times during the last twenty years, to which are now added the results of the examination of 171 stomachs by specialists of this Department. These stomachs came from 19 different States, the District of Columbia, and Canada, and were collected during six months of the year. The preliminary examination was made by Prof. F. E. L. Beal, who estimated the percentage of vegetable and animal food and, with the assistance of the writer, made a provisional analysis of the insect material. Subsequently the entire insect material was submitted to the Division of Entomology, and the insects were carefully identified under the direction of Prof. C. V. Riley, mainly by Mr. Theodor Pergande and Mr. D. W. Coquillet. A careful examination shows beyond all question that the kingbird eats many more injurious insects than beneficial ones, and although it eats many predaceous insects such as dragon flies (*Neuroptera*) and Ichneumonid insects which are decidedly beneficial, yet these evils are far outweighed by the immense numbers of harmful insects regularly consumed.

Scarcely any trait of the kingbird is so well known, or at least so largely believed, as its fondness for honey bees, but the mere fact that the birds are seen lingering about the hives is not sufficient evidence that they are doing any harm to the bees. Many of our best naturalists have contended that the injury to beehives was too slight to deserve notice, and that the myriads of destructive insects which were eaten repaid the farmer or even the apiarist many times over. It has been noticed also that the bird appeared to prefer the drones. Among the 171 stomachs examined only 14, or less than one-twelfth of the entire number, contained any traces of the honey bee (*Apis mellifica*), while the total number of bees found was but 50; of these, 40 were positively identified as drones and only 4 were unquestionably workers. The remains of the other 6 were so fragmentary as to render impossible anything beyond the determination of the species. In several cases in which the birds had been shot near a hive no traces of bees were found in their stomachs. The results of these examinations show that not more than 1 kingbird in 12 catches honey bees, and that not more than 10 per cent of the insects caught are workers.

Among the enemies of the bee may be mentioned certain insects, notably the so-called robber flies belonging to the family *Asilidæ*, which do far more damage than birds. These robber flies are large, stout,

long-bodied flies, often covered with stiff hairs. According to Prof. C. V. Riley, one species (*Trupanea apivora*) has been known to kill 141 honey bees in a single day. In the stomachs examined by this Department not less than 6 kingbirds were found to have eaten these robber flies, and in one case at least 6 flies were found in a single stomach. It is very probable, therefore, that the killing of these robber flies would compensate for the 4 working bees, which were all we know to have been killed by the 171 kingbirds.

Although practically insectivorous, the kingbird has long been known to feed on fruits of various kinds. Among many hundreds of complaints received by the Department during the last seven years regarding the destruction of fruit by various birds, the kingbird has been mentioned as a fruit-eater in only three instances, when it has been accused of injuring cherries and small fruits. Nearly 50 per cent of the 171 stomachs examined contained vegetable food in amounts varying from a mere trace to 100 per cent, but only 2 contained vegetable matter alone. Of the total quantity of food eaten about 12 per cent was vegetable matter, probably all fruit; the remainder consisted entirely of insects, spiders, and myriapods. No less than 22 species of fruits have been identified in the stomach contents. Three stomachs out of 24, collected in May, contained vegetable matter, mainly remains of raspberries or blackberries. In the stomachs collected in June and July were found remains of cherries, mulberries, blueberries, and huckleberries, the average amount for the month of June being 4 per cent and for July 8 per cent. In August more than twice as much fruit was eaten as in July, the average for the former month reaching 22 per cent, although the relative number of stomachs containing fruit was slightly smaller than in July. The relative amount of fruit and insects found in the stomachs is shown in the following table:

Month.	Number of stomachs examined.	Number of stomachs containing—		Average percentage of food.	
		Insects.	Fruit.	Insects.	Fruit.
April	3	3	.....	100	.....
May	24	24	3	97·5	2·5
June	32	32	6	96	4
July	49	49	32	92	8
August	59	57	36	78	22
September	4	4	4	55	45
Total	171	169	81	88	12